

REMARKS

Claims 1-3, 5-19 and 25-28 were previously pending in the application. Claims 1, 5, 14 and 19 have been amended. Claims 13, 25 and 27-28 have been canceled. New claims 29-32 have been added. Upon entry of the present amendment, claims 1-3, 5-12, 14-19, 26 and 29-30 are pending in the application.

Claim 1 has been amended to photoinitiators selected from the group consisting of benzoin, benzoin ethers, benzil ketals, acylphosphine oxides, bisacylphosphine oxides, phenylglyoxylic esters, camphorquinone, alpha-aminoalkylphenones, alpha, alpha-dialkoxyacetophenones, and alpha-hydroxyalkylphenones, as supported on page 10, lines 11-12, and original claim 5. Claim 1 has been further amended to recite that the mixture showed no increase in viscosity after 28 days at 60°C in the dark, as supported on page 39, lines 3-5. Claim 5 has been amended to narrow the group of photoinitiators, as supported by the original claim.

Claim 14 has been amended to recite that Component I further requires "a reactive diluent containing at least two free-radically polymerizable double bonds," as supported at least on page 13, lines 6-19. Claim 14 further recites that Component I has a solids content of 25 to 75 wt.% and a certain ratio of functional groups, as supported at least on page 10, lines 4-15, and page 30, lines 4-11. Claim 14 has further been amended to recite that Component(s) I and II contain their constituents in the form of molecularly dispersed solutions in organic solvents, as supported at least on page 8, lines 11. Claim 14 has also been amended to recite that each initiator is present "in an amount of 0.5 to 7% by weight, based on the solids in a dual cure composition formed from the two component or multicomponent system," as supported on page 10, lines 20-23. Finally, claim 14 has been amended to recite that Component I shows no change in viscosity after 28 days in the light or dark at 40°C, and Component II shows no increase in viscosity after 28 days at 60°C in the dark, as supported at least on page 38, lines 4-5, and page 39, lines 3-5. Finally, claim 14 has been amended to recited that the dual cure composition after having been cured has a storage modulus E' in the rubber-elastic range of at least $10^{7.5}$ Pa and a loss factor $\tan \delta$ at 20°C of not more than 0.10, as measured by dynamic mechanical thermoanalysis on free films having a thickness of 40 μm , as supported at least on page 28, lines 29-33. Claim 19 has been amended to

depend from claim 14.

Amendments to the claims, as set forth herein, are made in order to streamline prosecution in this case by limiting examination and argument to certain claimed embodiments that presently are considered to be of immediate commercial significance. Amendment of the claims is not in any manner intended to, and should not be construed to, waive Applicants' right in the future to seek such unamended subject matter, or similar matter (whether in equivalent, broader, or narrower form) in the present application, and any continuation, divisional, continuation-in-part, RCE, or any other application claiming priority to or through the present application, nor in any manner to indicate an intention, expressed or implied, to surrender any equivalent to the claims as pending after such amendments.

The Title has been replaced as required by the Office Action. 02/03/2009 Office Action page 2, first paragraph. The Title is now descriptive and mentions that photoinitiators are mixed with isocyanate groups and that the invention is useful in a coating composition.

1. Rejection of claims 1-3, 5-19, 25-28 under 35 U.S.C. § 112, first paragraph as failing to comply with the written description requirement.

The Office Action states that the Examiner has not found a teaching within the specification as filed to use a combination of photoinitiators wherein a unimolecular-type initiator and a bimolecular initiator are required in the combination. The Office Action states that Example II in the Table on page 39 comprises three different initiators, however, the Examiner has not found any disclosure of the chemical name or structure of the photoinitiator "Genocure MBF," so it is not clear whether it is a type I or type II initiator. The Office Action further states that it is the Examiner's position that one Example does not provide basis for the limitation.

Applicants have considered this issue carefully and do not find that the claims require both a unimolecular-type initiator and a bimolecular-type initiator, but only that the initiators be selected from a group containing both types of initiators. This is supported by the statement on page 9, lines 26-27, that "at least two, preferably two or three, initiators" are used. Also, the first

paragraph on page 10 states that these photoinitiators are selected “from the group consisting of unimolecular (Type I) and bimolecular (Type II) photoinitiators.” In addition, Applicants can confirm that the Genocure® MBF is a phenyl-glyoxylic ester, more specifically methyl phenylglyoxate, as indicated by the enclosed page from the supplier, Rahn. Accordingly all the photoinitiators used in Example 2, on page 39, are of the unimolecular type I, as that term is now defined in accordance with the art.

Applicants respectfully submit that, based on a correct interpretation of the claims, the claims indeed satisfy the written description requirement.

Reconsideration and removal of the rejection of claims 1-3, 5-19, and 25-28 under 35 U.S.C. § 112, first paragraph, are respectfully requested in view of the foregoing remarks.

2. **Rejection of claims 1-3, 5-19, 25-28 under 35 U.S.C. § 112, first paragraph as failing to particularly point out and distinctly claim the subject matter which Applicants regard as the invention.**

The Office Action states that Applicants’ description of unimolecular (type I) and bimolecular photoinitiators (Type II) does not appear to be in conformance with art recognized definitions of unimolecular type photoinitiators and bimolecular type initiators and is, therefore, confusing.

Applicants thank the Examiner for pointing out this confusion. Applicants have amended the specification and claims to conform with art recognized definitions. This rejection is, therefore, believed to be obviated.

3. Rejection of claims 1-3, 5-19, 25, 26 and 28 under 35 U.S.C. § 103(a) as being unpatentable over Hovestadt et al. (6,335,381) in view of Howard (4,188,455)

The Office Action states that Hovestadt et al. disclose an isocyanate-functional mixture with a photoinitiator and a two component system comprising the mixture and an isocyanate-reactive component, particularly in Example 3. The Office Action further notes that the urethane acrylate Component I contains free isocyanate groups, and Component II comprises a polyacrylate having hydroxyl groups and no photoinitiator. The Office Action further states that Hovestadt et al. teach that mixtures of different types of the disclosed UV initiators are suitable for use in the disclosed compositions (column 4, lines 23-28). The Office Action states that the difference from the instant claims is that Hovestadt et al. do not specifically teach a mixture of unimolecular photoinitiators with bimolecular initiators.

The Office, therefore, cites Howard for disclosing a photocatalyst system comprising a mixture of benzophenone with benzoin isobutyl or the like. The Office Action alleges, therefore, that it would have been obvious to employ more than one of the free radical photoinitiators disclosed by either Hovestadt et al. or Howard in combination with benzophenone.

Applicants greatly appreciate the detailed basis of rejection but must respectfully disagree to the extent the rejection is applicable to the inventions of amended independent claims 1, 14, and 19.

Hovestadt et al. (hereafter "Hovestadt") is directed to an aqueous coating composition. Importantly, Hovestadt is directed to the problems associated with the hardening of UV-initiated polymerization. The high volume shrinkage during hardening can result in adhesion problems. Also, the high crosslink density can result in brittleness and lack of impact strength. Col. 1 lines 14-29. Hovestadt provides a coating composition comprising an aqueous binder containing isocyanate reactive groups (col. 1, line 64, and claim 1 of Hovestadt.) In order to produce the aqueous binder composition, Component I is emulsified in aqueous resin Component II. Col. 5, lines 12-21. Hovestadt goes on to say that the requisite processing viscosity is obtained by adding water. Finally, referring to the Table in col. 7, lines 1-14, the polyacrylate materials are "neutralized" with dimethylethanolamine. Thus, they are dispersed as charged particles, rather

than molecularly dissolved in organic solvent as required by amended claim 14. Referring to the Examples in the present application, both Component I and II are non-aqueous.

Also, it is significant and should be noted that Component I of the present examples comprises a substantial amount of a reactive diluent, namely dipentaerythritol. In contrast, Hovestadt has no such reactive diluent in their non-cyanate Component II (corresponding to present non-cyanate Component I).

In view of the above, the composition of Hovestadt significantly differs from the present invention in regard to being aqueous rather than non-aqueous and lacking a substantial amount of reactive diluent in the non-isocyanate component.

Furthermore, the present compositions contain three different photoinitiators, indicating a very reactive coating composition which is surprisingly stable upon storage. As stated in the original specification, on page 3, lines 20-23, there is “a need for two-component or multi-component systems which on the one hand are particularly stable on storage and on the other hand produce dual cure compositions which cure rapidly to form defect-free cured compositions.” [Emphasis added.] It is further stated that the present system was surprising and unforeseeable because it would “have been expected that the highly reactive free isocyanate groups of the mixtures of the invention and of components (II) of the systems of the invention would enter into unwanted reactions with initiators activable with actinic radiation in the course of the preparation, storage and processing of the mixtures....even when combined with exposure to light.” Page 7, lines 15-32.

Thus, while the present composition comprises three different photoinitiators for a more rapid cure, the composition is still surprisingly stable. This is shown experimentally, in the examples on pages 35-38 of the present application.

Specifically, it was shown that when the photoinitiators were combined with Component I, containing isocyanate-reactive (non-isocyanate) groups and stored, respectively, at 8°C, room temperature (RT), and 40°C, in both daylight and in the dark, Component I (without the photoinitiators, in accordance with the inventive system) showed no changes even after 28 days of

storage in the light and in the dark. In contrast, the samples of Comparative Component C1 gelled completely after just a short time: C1-1 (8°C/light): 10 days; C1-1 (RT/light): 3 days; C1-1 (40°C/light): 1 day. In the case of sample C1-2 (40°C/dark), there was a significant increase in the viscosity; only the samples C1-2 (8°C/dark) and C1-2 (RT/dark) showed minimal increases in viscosity after 28 days.

With respect to isocyanate-containing Component II (Example 2), the inventive Component II contained a mixture of photoinitiator, whereas the Comparative Example Component C2 contained no photoinitiators. Component II and Comparative Example Component C2 were stored in the dark at 60°C. Component C2 showed no increase in viscosity even after 28 days, but surprisingly this was also the case for Component II. Consequently, it has been demonstrated that the inventive system of Component I of Example 1 and Component II of Example 2 was completely stable on storage without great expense, in contrast to the system of Component C1 of Example C1 and Component C2 of Example C2.

Finally, a clearcoat (Example 3) according to the present invention (using Component I and II of Examples 1 and 2) was compared to that of a comparative clearcoat (Example C3), containing C1+C2, in terms of a clearcoat material and the production of a multicoat paint system from them. In particular, the clearcoat of Example 3 used Component I after it had been subjected to a storage time of 28 days (40°C /light) and Component II after it had been subjected to a storage time of 28 days at 60°C. In contrast, Example C3 used freshly prepared Component C1 and Component C2.

After the respective components had been mixed, the resulting clearcoat materials were homogenized and a substrate (after being coated in succession with a cathodically deposited electrocoat, a commercial two-component water-based surfacer, and a commercial black aqueous basecoat material) was subsequently coated with the clearcoat materials (I+II) and (C1+C2). The aqueous basecoat films and clearcoat films were cured at room temperature for 5 minutes, at 80°C for 10 minutes, followed by UV irradiation in a dose of 1,500 mJ/cm², and finally at 140°C for 20 minutes. In the course of curing with UV radiation, an oxygen-depleted atmosphere

composed of air and nitrogen with 5% by volume oxygen was employed. (Thus, the air required for the photoinitiator combination of Howard was not present.)

Surprisingly, the multicoat paint systems of Example 3 and of Example C3 had essentially the same outstanding profile of properties in terms of brightness, gloss, hardness, scratch resistance, etch resistance, leveling, and surface defects, as experimentally measured and described in detail on page 41. It was found that the clearcoat material (I+II) of Example 3, prepared from the thermally and radiation-stressed Component I and II of Example 3, was, in all respects, essentially equivalent to the clearcoat material (C1+C2) of Example C3 which was prepared from the freshly prepared component C1 of Example C1 which had undergone neither radiation nor thermal stressing.

Furthermore, claim 1 has been amended to require that the three photoinitiators are selected from the group consisting of benzoin, benzoin ethers, benzil ketals, acylphosphine oxides, bisacylphosphine oxides, phenylglyoxylic esters, camphorquinone, alpha-aminoalkylphenones, alpha, alpha-dialkoxyacetophenones, and alpha-hydroxyalkylphenones, as supported by original claim 5. Similarly, claim 5 has been amended to recite that the photoinitiators comprise an acylphosphine oxide, a phenylglyoxylic ester, and an alpha-hydroxyalkylphenone. This is also supported by the Example and the Table on page 39, in which Irgacure® 184 can be identified as an alpha-hydroxyalkylphenone, specifically 1-hydroxy-cyclohexyl-phenyl-ketone; Genocure® MBF can be identified as a phenylglyoxlic ester, specifically methylbenzoyl formate (methyl benzoylformate), and Lucirin® TPO can be identified as an acylphosphine oxide, specifically 2, 4, 6-trimethylbenzoylphosphine oxide, as supported by the technical data sheets submitted herewith.

It is, therefore, noted that all three photoinitiators are of the unimolecular Type I, as presently defined. In contrast, Hovestadt discloses a crosslinking mixture comprising a single photoinitiator, in Example 3 thereof, unlike Applicants' invention of claims 1, 14, and 19, which claims require a mixture of three photoinitiators, i.e., wherein the mixture of at least three initiators is selected from the group consisting of a combination of unimolecular (type I) and bimolecular

(type II) photoinitiators or, in the case of claim 1, specifically a combination of unimolecular photoinitiators.

The use of a combination of three photoinitiators is not disclosed in Hovestadt. In particular, Hovestadt makes no mention of at least three photoinitiators, instead using a single photoinitiator in a relatively low amount in Example 3. Furthermore, Hovestadt makes no mention of the phenylglyoxylic ester (Genocure® MBF) of present claim 5.

Claim 14 further requires that each initiator is present in an amount of 0.5 to 7% by weight, for a total of 1.5 to 21%, based on the solids in a dual cure composition formed from the two component or multicomponent system. This is in distinct contrast to Example 3 of Hovestadt, in which the total amount of photoinitiator can be calculated to be 0.04%. Thus, Hovestadt does not address the issue of the higher amount of a mixture of photoinitiators as used for rapid curing in combination with storage stability. In fact, Hovestadt is not concerned with the problem of storage stability of both components of a two-component system and, in fact, makes no mention of storage stability or its problem. In contrast, present claim 1 states that the present mixture shows no increase in viscosity after 28 days at 60°C in the dark. Claim 14 states that, for a two-component system, Component I shows no change in viscosity after 28 days in the light or dark at 40°C, and Component II shows no increase in viscosity after 28 days at 60°C in the dark.

Finally, claim 14 recites that the dual cure composition, after having been cured, has a storage modulus E' in the rubber-elastic range of at least $10^{7.5}$ Pa and a loss factor $\tan \delta$ at 20°C of not more than 0.10, as measured by dynamic mechanical thermoanalysis on free films having a thickness of 40 μm . There is no reason to believe that the aqueous system of Hovestadt, with different materials, in significantly different amounts, would also meet those particular limitations.

The secondary reference to Howard cannot cure the above-noted deficiencies of Hovestadt. Howard is not even directed to a two-component or multicomponent system, let alone one having unexpectedly improved storage stability. Rather, Howard is directed to an unsaturated resin that is a reaction product of, among other reactants, a polyetherester polyol. Although Howard discloses a photocatalyst system comprising an admixture of benzophenone

and another photoinitiator, none of the three photoinitiators of present claim 1 is benzophenone. Example VIII, col. 15, of Howard uses either benzophenone, benzoin butyl ether, or a combination of the two. Furthermore, no isocyanate crosslinker is used in the Examples of Howard. Instead, Howard is directed to a radiation-curable system, not a dual cure composition, let alone a two-component system. Finally, the composition of Howard is designed to be cured in air. Abstract.

For an obviousness rejection to be proper, the Examiner must meet the burden of establishing that all elements of the invention are disclosed in the prior art; that the prior art relied upon, coupled with knowledge generally available in the art at the time of the invention, must contain some suggestion or incentive that would have motivated the skilled artisan to modify a reference or combined references; and that the proposed modification of the prior art will have a reasonable expectation of success, determined from the vantage point of the skilled artisan at the time the invention was made. *In re Fine*, 5 U.S.P.Q.2d 1596, 1598 (Fed. Cir. 1988); *In Re Wilson*, 165 U.S.P.Q. 494, 496 (C.C.P.A. 1970).

Taken as a whole, it is respectfully submitted that the cited combination fails to provide the requisite motivation for a *prima facie* case of obviousness.

Reconsideration and removal of the obviousness rejection of claims 1-3, 5-19, 25-26, and 28 is respectfully requested in view of the foregoing amendments and remarks.

4. Rejection of claims 1-3, 5-19, 25, 26 and 28 under 35 U.S.C. § 103(a) as being unpatentable over Hovestadt et al. (6,335,381) in view of Howard (4,188,455), as applied to claims 1-3, 5-19, 25, 26 and 28 above, and further in view of Sumita et al. (3,945,833).

Hovestadt and Howard are discussed above. Sumita et al. (hereafter "Sumita") is cited for disclosing a sensitizer comprising a mixture of benzophenone, halogenated benzophenone or a combination thereof and 4,4'-bis(diethylamino)benzophenone, which mixture exhibits a synergistic effect for photopolymerizing ethylenically unsaturated prepolymers. The mixture is used in a composition comprising acrylated epoxies and acrylated isocyanates.

Applicants respectfully submit that Sumita is no more relevant than Howard, discussed above, and cannot correct the serious deficiencies of the primary reference to Hovestadt. Again, like Howard, Sumita is not even directed to a two-component or multicomponent system, let alone one having unexpectedly improved storage stability. Rather, Sumita is directed to a printing ink having a wax and a prepolymer with crosslinkable double bonds. Abstract. Although Sumita discloses a photocatalyst system, it is quite different from that used in the present invention. Sumita claims the use of a halogenated benzophenone or amino-functional benzophenone of type II (bimolecular), unlike any of the three photoinitiators of present claim 1 or claim 5. No isocyanate crosslinker is used in the Examples of Sumita. Sumita is directed to a radiation-curable system, not a dual cure composition or two-component system.

5. Rejection of claim 27 under 35 U.S.C. § 103(a) as being unpatentable over Hovestadt et al. (6,335,381) and Howard or Howard in combination with Sumita et al., as applied to claims 1-3, 5-19, 25-26 and 28 above, and further in view of Baumgart et al. (7,064,165).

Hovestadt, Howard, and Sumita are discussed above. Baumgart et al. (hereafter "Baumgart") is cited merely for disclosing coating materials for multicoat systems. The Office Action concedes that Baumgart does not teach adding a photoinitiator to an isocyanate crosslinking component B, as in the present invention. Hence, Baumgart cannot teach the present invention or correct the above noted deficiencies of Hovestadt alone or in combination with Sumita and/or Howard, for the reasons already discussed above. None of the references teach solving the problem of simultaneously providing rapid cure of a dual-cure two-component system while, at the same time, providing greatly improved storage stability of each of the components as

specified by the present claims. Rather, Baumgart is directed to improved scratch resistance and etch resistance, wherein the crosslinking component comprises both flexibilizing segments and hardening segments. Abstract. Furthermore, Baumgart teaches away from the very heart of the present invention, as indicated by the composition in the Table in col. 22 of Baumgart.

Baumgart appears to be relied upon by the PTO only for its disclosure of effect paints or multicoats and thus does not rectify the above noted deficiencies of Hovestadt. Taken as a whole, it is respectfully submitted that the cited combination fails to provide the requisite *prima facie* case of obviousness.

To establish a *prima facie* case of obviousness, three basic criteria must be met. First, there must some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings. Second, there must be a reasonable expectation of success. Finally, the prior art reference (or references when combined) must teach or suggest all the claim limitations. MPEP 2143.

Reconsideration and removal of the obviousness rejection of claims 1-3, 5-19, 25-28 is respectfully requested in view of the foregoing remarks.

New Claims:

New claims 29-30 are presented to further distinguish from the invention. In particular, new claim 29 recites that the reactive diluent contains at least four free-radically polymerizable double bonds, and new claim 30 recites that the reactive diluent comprises pentaerythritol tetraacrylate and/or dipentaerythritol pentaacrylate, as supported on page 13, lines 6-19.

CONCLUSION

Applicants respectfully submit that the Application and pending claims are patentable in view of the foregoing amendments and/or remarks. A Notice of Allowance is respectfully requested. As always, the Examiner is encouraged to contact the Undersigned by telephone if direct conversation would be helpful.

Respectfully Submitted,

/MaryEGolota/
Mary E. Golota
Registration No. 36,814
Cantor Colburn LLP
(248) 524-2300

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CORRESPONDENCE ADDRESS ONLY

BASF CORPORATION
1609 Biddle Avenue
WYANDOTTE, MI 48192
Customer No. 26922

MEG/CPK